Vol 24, No. 2 THE JOHNSON NATIONAL DRILLERS' JOURNAL Mar.-April, 1952

GROUND WATER RESOURCES AND THEIR CONSERVATION

GROUND WATER SURVEYS

Industries, municipalities, irrigation projects, and other large users of water are frequently forced with the problem of either developing new ground water supplies or increasing their present supplies. Too often such developments are made after very little study of the ground water formations available, their maximum storage capacity, their safe yield or of the factors which determine whether or not the proposed development is feasible.

The usual practice is to put down one or two test holes nearby and take it for granted this is all of the information needed. Perhaps more than one test hole is put down, but if these have no relation to each other or the water-bearing bed, then the money is wasted. On the other hand, if accurate and sufficient testing is done, this is the best money spent. It will be repaid many times during the life of the project.

Before any one can carry out a test program and call it a ground water survey, they must be prepared to do a lot of things that have no relation to or connection with test holes. Not many well drilling contractors and very few engineers have the training, experience or equipment necessary to make a ground water survey as the term is used by ground water hydrologists. Therefore, many so-called ground water surveys are in reality nothing more or less than prospect or test programs which can be carried out by any up and coming well driller.

The material situation as a whole seems to be easing, with the exception of products containing copper.

We hope the time comes when we can return to normal and forget the "red tape." Until then all that we can do is to supply our customers with screens as promptly as possible from the material we have available.

Therefor, please tell us of your needs as far in advance as possible and we will do all we can to furnish you with copper alloy screens when you want them.

What then is a ground water survey? This may be answered by saying that it is an investigation of any proposed area for the purpose of determining its safe yield of ground water. The area may be hundreds of square miles in extent or as little as a city block. The extent and type of the investigation to be made is directly related to the character and importance of the proposed development. Manifestly it would not be economical to spend $3,000.00 for a ground water survey prior to the construction of a pumping well that would cost maybe $6,000.00 to $10,000.00. On the other hand, it would be risky to spend only $3,000.00 on an irrigation development which when completed would involve forty or fifty pumping units to say nothing of the entire success of the project. In the same way, municipalities faced with developing ground water supplies in unknown areas or at considerable distances should always spend enough money on real ground water surveys to warrant the expenditure whether it be large or small.

We might next ask how are ground water surveys made? This again can be answered by saying they are made by trained experts with the proper equipment but this does not fully answer the question in the average person's mind, as ground water surveys involve a knowledge of many things other than the actual work done in the field.

Most ground water surveys are preceded by a thorough study of the site, its topography, its geology, its drainage, the number of pumping wells in it, their total pumpage, etc. By "site" we mean the entire area which may be affected by the new wells. This study often covers the country for miles around the probable well sites. This takes field work on the surface. Next comes the sub-surface or underground investigation. The local geology is first carefully studied.

If this information is not available in either state or government departments, it must be obtained by a filed investigation made by competent people. Preliminary investigations of this kind are usual-

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Electrical seismograph set up for field use.

GROUND WATER SURVEYS

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ly made in one or the other of two ways, either by the use of geophysical methods or the use of small diameter test holes put down by some rapid method that will get the required basic geologic data quickly and at the lowest cost consistent with good practice.

Geophysical methods have now been developed to the point where they can be used with sufficient accuracy in the ground water field by geologists, engineers, hydrologists, and others familiar with this sort of work. There are two ways of approaching a job of geophysical testing, either entirely from the surface or from test holes or well casings extending below the surface. If the surface approach is used, then either resistivity or seismic methods are used. Briefly, resistivity testing consists of measuring ground resistance by means of electric currents introduced into the subsurface formations. This is done by making a "ground" connection consisting of a series of metal rods driven in the ground. Electric current is then supplied to these "grounds" which is dissipated into the earth. By measuring the differences in the resistance of a current passing between two "grounds" or electrodes, differences in the electrical conductivity of the rocks or soils penetraded can be determined. From these resistance measurements it is then possible to determine the depths to various changes in the formation, also the water table. By changing the spacing of the "grounds" or electrodes, the electric current can be distributed over larger areas and to greater depths. Like all geophysical methods, the necessary electrical equipment is required and it must be used by people experienced in this sort of work.

This method is particularly useful in ground water explorations as sands and gravels below the water table have low resistivities while dry deposits of sand and gravel have high resistivities. Inasmuch as most deposits of this kind have beds of clay of fine silty material in them, the expert can detect the approximate depth, thickness, and extent of such beds. This method is also effective in disclosing hidden valleys containing water-bearing deposits. Several of our states have set up departments provided with men and equipment to make ground water surveys. No doubt many others will do so in the future as new and simpler methods are developed. At the present time the U. S. Geological Survey is making geophysical explorations daily. Illinois in their Water Survey Division is offering such work as a service to the people of that state. In addition, we have heard of such work being done by the Water Resources Board of Ohio and the State of Massachusetts. No doubt there are others both public and private doing this kind of work, but the field of geophysical engineering in ground water is only just getting started. There is no doubt such methods are here to stay, but the old fashioned test hole must still be called upon for the definite reliable and detailed information required for an engineering ground water survey.

Seismic methods are entirely different than resistivity methods in that they are much older and are based upon registering the intensity of shocks imparted to a formation by the use of explosives and then comparing these shocks to others in different locations. In using this method of exploration, advantage is taken of the fact that various formations transmit shocks or sound waves at different velocities. Unconsolidated sands transmit these sound waves at

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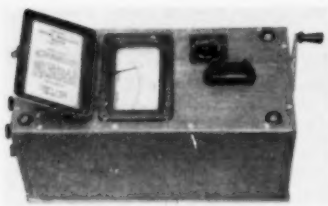
Martin Sundin machine shop and camp on government test hole job. The river nearby rose 20 feet in spring breakup one week later, flooding the camp site.



"Megger" ground tester.

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velocities varying from 1,000 to 6,000 feet per second, while solid rock formations will transmit a shock of the same intensity at velocities of 16,000 to 20,000 feet per second.

In other words, this is a method of directly measuring the stiffness or rigidity of underground formations. The oil well people developed these methods many years ago and have used them with considerable success. However, these methods have not been used extensively in the water well field as more delicate methods must be used. Furthermore, resistivity methods are cheaper and give more positive hydrological information. Actually there are two methods of seismic testing, reflection shooting and refraction shooting. The first method is not used for shallow explorations at all and the second is used so little in the water well field that these methods will not be discussed further.

If subsurface resistivity methods are used, they are often referred to as electric logs. Such a log may be secured from a test well or a well casing in place, either of which must penetrate the formations to the basic rock. The basic principle of electric logging is the measurement of two electrical quantities, i.e., electrical resistance and electric potential. The electric resistance of most formations is determined entirely by the chemical nature of the water in the formations penetrated. Naturally the resistance varies between one formation and another in a drilled hole. These are recorded automatically as an electrode is lowered into the well.

Measurements of potential differences in voltage can be made with the same equipment by simply changing the electrical connections and using a voltmeter. The difference in voltage between any two points can be observed as the electrode is moved up or down in the drill hole. These observations plotted on a continuous chart with the resistance measurements give two curves from which the experienced operator can determine the depth and thickness of water-bearing formations with reasonable accuracy.

Equipment for making such tests is now available at a reasonable cost and several companies are in the business of making such tests on a contract or fee basis.

When geophysical methods are not used, an area is often examined by prospecting with light portable drilling equipment. While such holes are often referred to as test holes, they are not the same type as the test holes which will be required later. For this reason they are referred to as prospect holes. The purpose of course is to thoroughly explore as large an area as possible quickly. Prospect holes are put down rapidly with light portable equipment, usually by rotary methods in such a manner that they cover the area in a definite pattern. The actual distance between holes may vary from 1,000 feet apart in all directions to as much as a mile apart, depending on the formations and area to be covered. Prospect holes will divulge the depth to the basic rock, the general nature and thickness of the formations penetrated, and other information which will be helpful in sizing up the situation. One weakness of prospecting is that it may be difficult to determine the depth to the water table. It is impossible to determine the difference between two water levels if two aquifers with different static levels are encountered.

Regardless of the preliminary methods of exploration used, the next step is to interpret and evalu-

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Determining depth to rock by measuring earth resistivity.

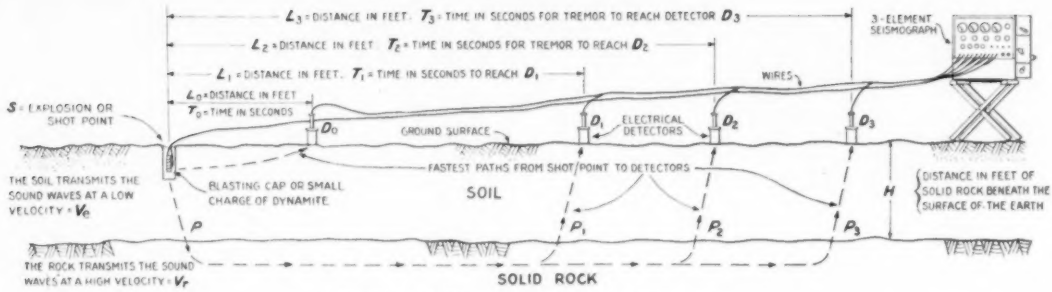
L_3 = DISTANCE IN FEET. T_3 = TIME IN SECONDS FOR TREMOR TO REACH DETECTOR D_3
L_2 = DISTANCE IN FEET. T_2 = TIME IN SECONDS FOR TREMOR TO REACH D_2
L_1 = DISTANCE IN FEET. T_1 = TIME IN SECONDS TO REACH D_1
L_0 = DISTANCE IN FEET
T_0 = TIME IN SECONDS
3-ELEMENT SEISMOGRAPH
WIRES
S = EXPLOSION OR SHOT POINT
D_0
GROUND SURFACE
D_1
ELECTRICAL DETECTORS
D_2
D_3
FASTEST PATHS FROM SHOT POINT TO DETECTORS
THE SOIL TRANSMITS THE SOUND WAVES AT A LOW VELOCITY = V_0
BLASTING CAP OR SMALL CHARGE OF DYNAMITE
SOIL
H
DISTANCE IN FEET OF SOLID ROCK BENEATH THE SURFACE OF THE EARTH
P
P_1
P_2
P_3
THE ROCK TRANSMITS THE SOUND WAVES AT A HIGH VELOCITY = V_r
SOLID ROCK

Diagram of theory of seismic measurements.

GROUND WATER SURVEYS

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ate the results. If the work has been carefully done and adequately supervised, it will be apparent where the best water-bearing formations are located, their general areal extent, depth, and approximate grading of unconsolidated formations, that is, whether they are loose sand and gravel, cemented sand and gravel, sandstone, or solid rock . With this information available, the investigation is continued by laying out a program of test holes that will confirm or disprove the preliminary findings. Naturally these test holes are located where the indications are the most favorable, as far as water-bearing formations are concerned. These test holes are cased and of sufficient diameter to allow formation samples to be taken that are representative of the formations. As a general rule, such test holes are put down using standard drilling equipment. Rotary holes or any other method using water to force the samples to the surface cannot be considered adequate for this kind of testing.

After the formation samples have been labeled and numbered, they are ready to be examined by some one who has had sufficient experience in this sort of work, some one who is able to recognize the formations that have been penetrated and judge of their water-bearing ability. Naturally enough test holes are put down in the proper locations to obtain all of the information necessary.

The data is then plotted and mapped, showing the relative elevation of each test hole and the static water level in each. Frequently this is all that is done and decisions are made from the data available at this time. Such work is often referred to as a ground water survey when it is actually nothing more or less than a program of testing, which any experienced well driller can carry out. To make a ground water survey in the fullest sense of the word, the engineer or hydrologist in charge must consider several other factors having to do with the project and then prepare a ground water inventory.

Here is where technical knowledge of the highest order comes into the picture, as some knowledge of geology, ground water hydrology, chemistry, and economics is required to prepare such a report. These factors which must be studied in detail are:

1. A determination of the storage capacity of the ground water reservoir and whether it will function as a conduit or storage reservoir under pumping.

2. An estimate of the amount of recharge that may be expected from streams, lakes, and annual precipitation.

3. An estimate of the amount of discharge from existing pumping wells, losses to other formations, evaporation, transpiration, losses to springs, streams and lakes, etc.

4. The fluctuations of the water table monthly, seasonally, and annually, and their significance.

5. An estimate of the safe annual yield of the reservoir based on field determinations of permeability and transmissibility of the water-bearing formations.

6. Actual well locations and type of wells to be constructed to obtain the maximum safe yield with the least drawdown under pumping without interfering with any other well in the area.

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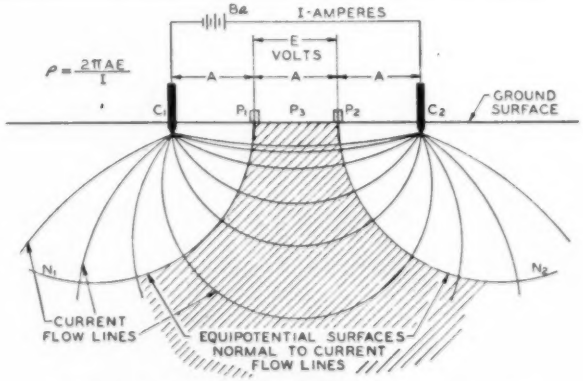

Diagram of theory of earth resistivity measurements.

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7. The type of pumping equipment that should be used to obtain maximum pumping efficiency at the least cost.

To make all of these determinations, requires considerable study and a field pumping test to determine permeability, or the actual amount of water that the formation can transmit under pressure. In earlier days, estimates of this kind were made by determining the velocity of flow and effective porosity of the formations available. Since the Thiem formula for determining permeabilities in the field was brought out, further work has been done by recent investigators which has simplified the process of obtaining such information. Permeability tests may be made in the laboratory, but the results may and usually do vary considerably from the actual field conditions. For this reason field determinations of permeability are considered more reliable though they involve more time and expense.

Basically, field testing for permeability by the Thiem method is the application of Darcy's rule of hydraulics, that the rate of flow through a formation is directly proportional to the hydraulic gradient. As it usually is of more interest to know the actual quantity of water flowing through a formation rather than the velocity of flow, Darcy's law has been expressed by the simple formula Q = P I A in which Q is the quantity of water discharged in a unit length of time, P is a constant depending on the character of the formation, I is the hydraulic gradient or slope of the ground water curve created by pumping, and A is the cross-sectional area through which the water is moving. From this basic formula, several methods of determining field permeability have been worked out such as equilibrium, non-equilibrium and recovery methods, each with their own version of the basic formula. All of them require the installation of a pumping well with observation holes put down at the proper places to obtain the data required. Inasmuch as the equilibrium method differs very little from the non-equilibrium method, these two methods are practically the same. The recovery method is not generally used though both Theis and Muskat have worked out formulas for this method.

No matter which method is used the actual field work, including the well installation, must be supervised by technical men experienced in this sort of work. Needless to say that any of the field methods when properly done are more reliable than laboratory methods in which the formation is removed and then rearranged in the laboratory. Inasmuch as all of the formulas require assumptions to be made, the differences between the assumptions and the actual field conditions may lead to errors that place the entire determination in error. For this reason alone, it is almost impossible for the average engineer or investigator to make field determinations of permeability within the accuracy required, unless he carefully studies the field and then checks his results by using several of the formulas that are available.

Some well drillers say they will make a ground water survey at little or no cost as an inducement to award the job of drilling wells to them. Manifestly such so-called surveys are not carried in the manner just described and are not serving the purpose of a ground water survey. The facts are that many important ground water developments are not preceded by sufficient study and investigation. The result is that many times economic losses are suffered which could have been prevented if an adequate ground water survey had been made prior to making the development. In some cases ground water surveys are made after the development has failed in order to determine the cause of failure.

To summarize, complete ground water inventories should only be made by those qualified to do so and they should include sufficient investigation to determine all sources of supply to the ground water area under consideration, also all losses from it. The difference between these two factors is the amount of water in storage. After this is known, the safe annual yield can be estimated.

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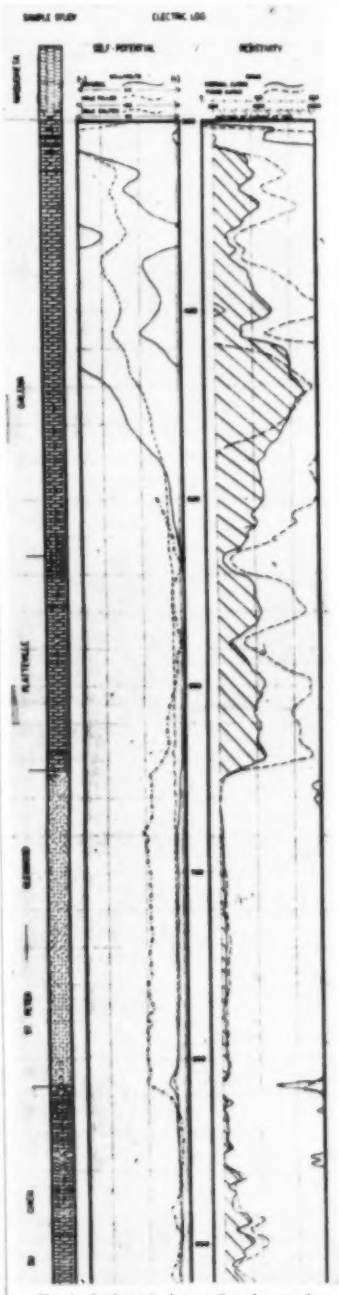
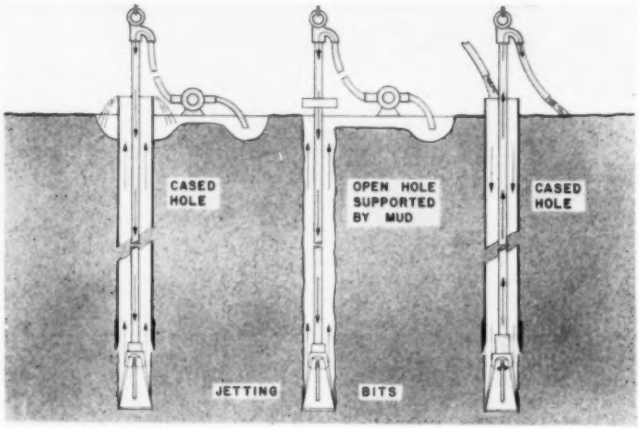


Typical electric log. Can be made in either cased or open drill hole.



Jetting-Rotary and Hollow Rod methods of putting down test holes.

GROUND WATER SURVEYS

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All investigations of this kind should cover sufficient area to get all of the facts and not be limited to a small area which may or may not represent the geologic and hydrologic conditions throughout the field. Furthermore, it should be kept in mind that all investigations of this kind are in the last analysis only estimates made after study and research. The methods used are constantly being enlarged and improved; however, we are not at the point even today where ground water surveys can be considered absolutely accurate.

The thing we need most to protect and conserve our ground water resources is more data and information on the occurrence, quantity and quality of these resources. This information should be published and be available for any one contemplating a major ground water development or now depending on ground water for public or private enterprise.

The collection of this data will be largely the responsibility of government agencies. It will involve data on precipitation, evaporation, and the amount of water in the atmosphere. It will also include more information than we now have on the occurrence, movement, and amount of water in our ground water reservoirs.

"What's the matter with your finger?"

"Oh, I was downtown getting some cigars yesterday and some clumsy fool stepped on my hand."

—o—

Timid Aunt — "Do you ever worry about losing control of the auto?"

Nephew — "I'll say I do. I'm three installments behind."

—o—

"Is it true that McTavish has bought the service station at the corner?"

"I think so. The 'Free Air' sign has been taken down."

HOW TO BUILD BETTER IRRIGATION WELLS

The purpose and benefits derived from pump irrigation are so well known and recognized by all that this phase of the subject can be taken for granted.

However, there are factors entering into all pump irrigation jobs, whether a single well or several, that are vital to the success of the project. These are:

1. A supply of water that can be pumped economically for the crop being raised and at the same time not exceed the annual replenishment or "safe yield" of the supply.

2. Wells of modern scientific design which will function efficiently for an indefinite period of time.

3. Pumping equipment that can be maintained at maximum efficiency without expensive repairs or periodic withdrawal from the wells.

When these three factors are present in an irrigation well, then places can be made for the beneficial use of ground water, over a reasonable period of time. The difficulty is that we seldom find these conditions in an irrigation well. A survey of the field will show that many ground water supplies have been "overpumped," some to the extent that the individual units have become inefficient and expensive to operate. This has undermined the original

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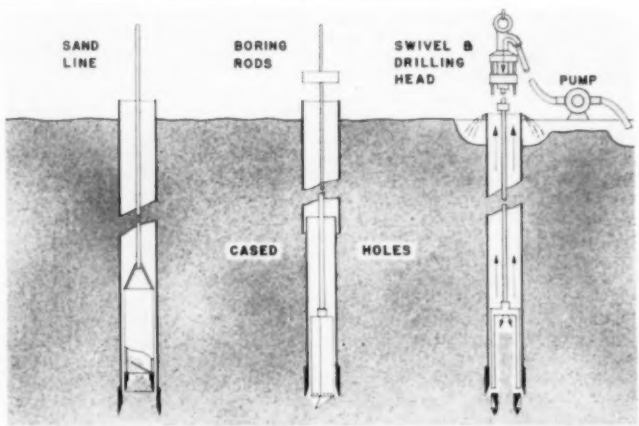

Sand Bucket—Boring and Coring methods of putting down test holes.

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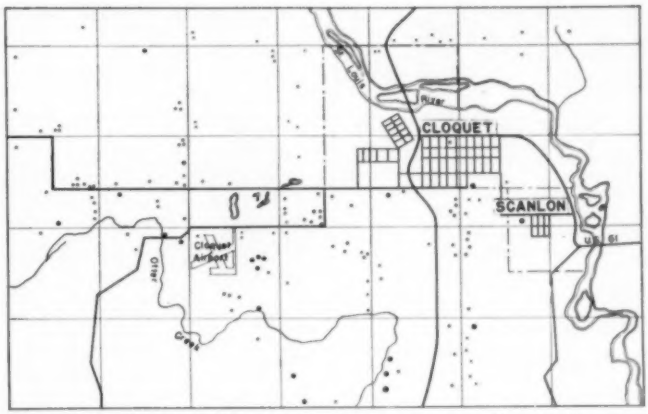
plans in some cases and has resulted in heavy losses to the pump irrigators.

As for the wells used in the irrigation field, little attention has been paid to the fundamentals of good well construction. Cheap materials and methods of construction have been used, which in the light of our present-day knowledge of wells has in many cases been directly responsible for tremendous losses.

The experience with pumping equipment has been the same. The idea being to assemble the cheapest combination of well and pump possible and then pump water as long as possible, without regard to any one else. This policy has led to many failures of pump irrigation projects and given a black eye to others.

Today we are faced with the problem of conserving ground water and using it to the best advantage or not using it at all. This means that better wells will have to be constructed and equipped with pumps of maximum efficiency. This brings us to the question of better wells and how to build them. This is done by giving consideration to three basic engineering fundamentals which have been largely disregarded in the past.



Location of well and test holes for ground water survey at Cloquet, Minnesota.

1. Well drilling methods should be used that will not destroy or even endanger the natural yielding ability of a water-bearing formation. This will mean that some of our present methods will have to be abandoned or altered in order to build better wells.

2. The materials used in casing and screening wells will have to be more carefully selected for strength, corrodability, and handling. These phases of good well construction have been almost totally neglected in the past and consequently many well failures can be laid on this doorstep.

3. The screening and gravel treatment of granular water-bearing formations must be done scientifically, not by guess and by gosh. Probably this one feature of well construction has contributed or been the cause of more well failures than any other.

While the details of good well construction have been sidetracked for economy in the past, this is no longer the case. Better wells can now be constructed using the proper materials, scientifically designed screens, and modern methods of well construction. When necessary to use gravel treatments, they can be designed and placed without fear of failure. Inasmuch as most sand-gravel formations do not require gravel treatment, the use of screens with properly spaced and shaped openings is essential, in order to allow development work to be done after the screen is in position. In some parts of the country this is a phase of well construction that has never been practiced.

All up-to-date well builders now develop a well to complete it and bring it to its maximum efficiency. This is just a little extra work done after the well is installed. It requires no expensive equipment or special skill. The purpose of development work is to pull fine sand from the water-bearing formation into the well.

William R. Friend of Montpelier, Ohio built this drilling rig and operates it in that area with Bill Stone. Mr. Friend is second from the left and Mr. Stone on the right in the peiture. The well is pumping 20 g.p.m.

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TOM'S COLUMN

Dear Fellows:

Well here we go again, mud up to the hubcaps, slush all over the place, and wind an' weather forecasts about as reliable as a medicine man's cure fer what ails you. This is my poetic way of announcin' that spring is here fer those who can locate it. In sizin' up our shebang here these tired eyes can't help noticin' the tool shed is fightin' a losin battle with a lotta playful surface water, water spouts are clogged up, door frames are saggin' an' some of the equipment is acquirin' a nice coat of tan colored rust. All it ever needed was a touch of mild ambition on my part an' most of the work I'm facin' up to now would'nt need to be done. You know how it is, we're always kiddin' ourselves that some day in the hazy future we'll be fired by hefty ambitions to clean up things that oughta be done today. To us old slow movin' critters these glad tidings of spring are messed up with wet feet, rheumaticks, an' a sluggish feelin' whenever work is mentioned. Swig McGrew used to figger that it was the season that oughta be preserved in alcohol an' he sure did his full share in carryin' out the idea. There's one thing that's brightenin' up fer drillers though, an' that is there's lots of business shapin' up. Around our little bailiwick I don't seem to remember any season that looked more promisin'. It won't be all beer an' skittles as the fellow says, because us drillers have got to do more downright thinkin' about producin' water supply rather than just punchin' holes at so much per foot. I sat in at a state drillers meetin' recently an' got quite an earful about some of the things we do that rises up later to hamstring us plenty. Afterwards I had to admit to myself that some of the trouble I got into could be traced to careless work at the very beginnin'. One job we fouled up sure got me into a jam before we finally got straightened around. Fer a long time I thought I could fix the blame on somebody else, used up a lot of profanity, bellyached to the screen people, tried to hang it on the pump installations, got into a row with the helpers, an' finally did the sensible thing an' found out what was wrong. An' do you know what was wrong? Well sir, it was nothin' but careless handlin' of the sand samples that I furnished, an' was my ears red when they showed me in black an' white that the whole job was haywire because I had started everybody off with wrong information. It was one of those jobs where I'd agreed in the contract to guarantee 500 gm. Competition was tough an' I figgered I had to make the guarantee. What burns me up is that if I had paid attention to takin' my samples right there would'nt have been any problem about makin' good on the guarantee. As you know there's printed instructions for takin' Formation samples that every

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D. E. Whelan, Secretary ..... Providence

South Dakota
Martin Sather, President ..... Presho
Harold Norbeck, Secretary ..... Redfield

San Joaquin Valley (California)
Jack De LaGrange, President ..... Madera
Glen V. Slater, Secretary-Treasurer ..... Fresno

Texas
O. F. Jensen, President ..... Houston
Geo. Ringstaff, Secy.-Treas. ..... Houston

Virginia
J. G. Perry, President ..... Richmond
Jack Sundquist, Secretary ..... Norfolk

Washington State
Oliver F. Zinkgraf, President ..... Spokane
O. E. Erdman, Sec'y-Treas. ..... Elma

Wisconsin
Beck Goldbeck, President ..... Appleton
Ralph H. Nienow, Executive Secretary ..... Merrill

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driller has or can get fer the askin. I have 'em all around the place. I've read 'em plenty of times. There was'nt no excuse in the world fer me to mess up that job, but we sorta get into the notion that we know it all just because sometimes we get by with it.

When all the chips was down I found out that instead of providin' information that would help properly buildin' that well, all I done was to damage the well more then if I had'nt sent any samples at all. I lost dough an' I certainly did'nt make a a good impression on the concern I was dealin' with.

Here's some of the things I found out that us drillers often do—just because we're careless or lazy or don't understand what samples are for.

In the first place, you can get sample bags with labels attached free, but most of the time samples are sent in bottles, fruit jars, tobacco tins. They're hardly ever packed right so they arrive broken an' badly labeled. We expect these folks to make analysis of the stuff, an' they do the best they can. If the dope we give 'em is wrong the analysis can't be worth anything to anybody. You can save yourself trouble an' money by readin' your instructions right now — if you aint got any see that you send fer a copy, Johnson's will furnish 'em. Let me point out one or two things to make sure of—first, careful packin' an' full information on the label. Each sample should be labeled as to depth (.....feet to .....feet....) from which it is taken as to its place in the log.

The information that is most important if you want a real analysis is . . . **Well diameter an' static level** . . . nature an' thickness of the formation just above the first sample an' whether it's hard or soft material. . . Method to be used in settin' the screen whether pull back or by bailin'. . . Amount of water wanted, if available, . . . remember these people aint mind readers, they must be guided by the information YOU give 'em. Now as to takin' samples, first you take a sample on entering a water bearing formation. . . Then take samples whenever changes show up—or at intervals of 5 feet if there aint no changes . . . remember to show on each sample the thickness of formation they represent, like f'rinstance if it's 61 to 81 feet, say so—don't just say 61 feet or whatever depth the sample was taken. . . . You can see that this is important because how does the guy back in the labratory know about the formation above or below the depth you have marked.

Mr. G. G. Rolston of Dupo, Illinois (on right) drilling an oil well with a No. 16 Ideco rig near Sparta, Illinois. His helper, Paul Amos, is on the left.

The only reason I'm bringin' this up now is that a lot of us slip because we figger certain methods worked all right on one formation an' that should mean that it automaticaly will work on another. We're finding out the hard way that this development work in well construction calls fer usin' your head. In the case I been talkin' about I went through all the motions, an' it cost just as much, but all the work I done actually damaged the well instead of helpin' it. A lot of us know plenty about handlin' equipment but get messed up when it comes to makin' a study of formations . . . that's where we need help an' we can get it if we know enough to follow instructions in takin' our samples. You know there's times when its mighty important to know if a formation will stand any development at all, an' how much. Same way when you hear talk of gravel treatment. As a speaker at the meetin' told us, a lot of us drillers think gravel treatment is fer producin' more water but that aint it, its done so's to control fine sand formations an' in a way to get the best results. There are cases where if you did'nt have proper gravel treatment it would'nt be possible to get any well. Anyways, the moral is no driller can afford to do modern jobs by guess, 'specally if there's guarantees tied to the contract. Furthermore if you start wrong by misleadin' everybody concerned with samples that aint got any relation to the factual situation—then the whole deal will wind up wrong.

Nowdays we can keep in touch with new equipment, knowledge an' know how. It'll make a whale of a difference when the time comes to totin' up the balance sheet.

Well, there's a lotta politickin' goin' on. Can't head into a lonely side road now days without runnin' smack bang into a mud caked candidate fer something or other. Havent met so many people in years who want to shake me b' the hand an' slap me on the back. Great life aint it, this bein a taxpayer. We growl about these people in public office, yet none of 'em could be parked there if we did'nt pave the way wid our votes.

The rig is lookin' spattered an' forlorn so guess I'd better give her a rub down. Good luck to all of you.

Yours truly,

TOM.

A Corpus Christi sailor passed away and upon arriving at the gates of his eternal home, remarked, "Gee, I never thought heaven would be so much like Texas."

"Son," said the man at the gate sadly, "this ain't heaven."

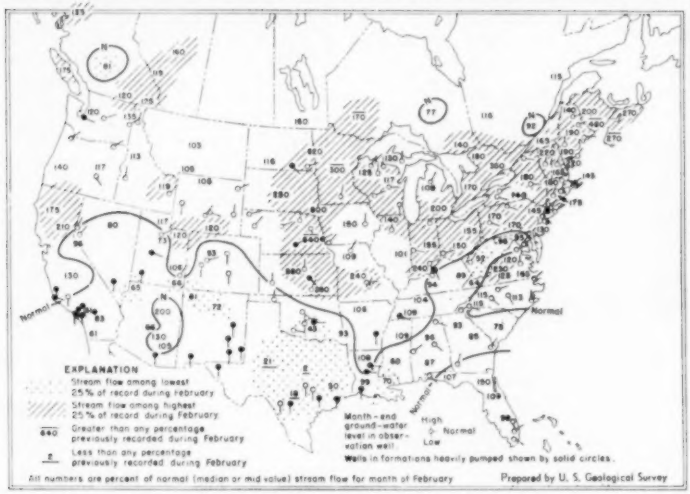
—o—

A party of tourists came upon an Indian brave riding a pony. A heavily burdened squaw walked wearily beside him.

"Why doesn't the squaw ride?" asked one of the tourists.

"Ugh," grunted the Indian, "she got no pony."

SURFACE and GROUND WATER CONDITIONS


EXPLANATION
Stream flow among lowest 25% of record during February
Stream flow among highest 25% of record during February
640 Greater than any percentage previously recorded during February
2 Less than any percentage previously recorded during February
Month-end ground-water level in observation well
High
Normal
Low
Wells in formations heavily pumped shown by solid circles.
All numbers are percent of normal (median or mid value) stream flow for month of February
Prepared by U. S. Geological Survey
Normal
Normal

STREAM FLOW AND GROUND WATER IN RELATION TO NORMAL, FEBRUARY 1952

The January report of the U. S. Geological Survey reported high runoff in many of the eastern states. In New England ground water levels continued above normal with levels in key wells at record highs. Floods were reported in parts of Pennsylvania, Ohio, Indiana, Illinois, Michigan, and Wisconsin. In Minnesota both streamflow and ground water levels were above normal.

The drought in the Southwest was particularly relieved as far as surface water supplies are concerned, though ground water levels still remained low. Ground water levels in Wyoming were near normal, while in Colorado they declined in all key wells. In the Gulf States runoff was deficient and ground water levels were generally lower over much of the area.

The February report was very similar to January though there were changes in several parts of the country. The Northeast section through Pennsylvania and New Jersey to the Canadian border showed excessive streamflow, with ground water levels ranging from average to record highs.

Ground Water continued at high levels in the New England states and were normal in upstate New York. On Long Island the recovery trend of record high levels has persisted since June 1947 when pumping was reduced more than half.

In the north-central states ground water levels and streamflow were high north of the Ohio River and west to the Great Plains. In Michigan ground water levels were considerably above normal in the Menominee River basin of the northern peninsula. Iowa also reported ground water levels generally above normal. The record high levels of last summer and fall continued with a new high observed in a key well near Garden City.

Runoff and ground water levels were about normal in the southeastern section, with levels in the northern and eastern part of North Carolina above normal. In Jefferson Davis Parish in Louisiana heavy pumping has kept ground levels low for eleven consecutive months.

The drought in Texas continued over most of the state but was relieved somewhat along parts of the coast, though there was no runoff in the Colorado or Pecos River basins. All observation wells showed ground water levels at new lows.

To the northwest ground water levels and runoff were mostly within the normal range. Arizona showed considerable runoff in places but ground water levels were considerably below normal with a new low for February in the 22-year record of a key well in the Tucson area. Record lows were established in all parts of New Mexico where ground water is used for irrigation.

ASSOCIATION NEWS

This section is devoted to the exclusive use of water well drillers' associations, both state and local. Notices, announcements, changes of officers and other items should be sent to The Editor, Johnson National Drillers' Journal, 2304 Long Ave., St. Paul, Minnesota.

EMPIRE STATE MEETING

The annual meeting of this association was held in Oriskany, New York on January 16 as planned, with a good representation of drillers.

Among the speakers was Mr. E. S. Asseltine of the U. S. Geological Survey who discussed the activities of that agency. Mr. Brashears of the U. S. Geological Survey was present and added his comment on the situation as to any contemplated legislation affecting drillers.

The new officers elected for 1952 are: James Stoutenberg, Glenford, President; Fred Merrill, Liverpool, Vice-President; Clarence Crandall, Pine City, Secretary-Treasurer;

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F. J. Crandall & Son, Pulaski, New York, drilling for gas on a farm south of Watertown, New York. They expected to go 1,200 feet if necessary.

Messrs. John Mowlem & Co., Ltd., a firm of Civil Engineers in London, have a drilling division operating in India. Mr. R. Astbury who is in charge of this division is a British Engineer. He supervises the work of four No. 71 Speed Star drilling rigs, three No. 22W Bucyrus-Erie rigs and one Failing No. 314-G rotary rig. Mr. George Taylor of the U. S. Geological Survey has recently completed an extensive ground water survey in the area for the Geological Survey of India. (Bucyrus-Erie rig shown).

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Lee Bates, Rome, three-year Director. The meeting ended with a banquet, music and dancing.

OHIO MEETING

Mr. E. D. Allen, Executive Secretary-Treasurer, recently attended a joint meeting of the Ohio Water Resources Board, the Advisory Committee, and the Anti-Pollution Board which recently has been set up, the purpose of which is determining whether or not steps should be taken towards controlling all waters in the state, both surface and underground.

OREGON MEETING

At the 2nd annual meeting of this group held recently in Portland, the following officers were elected for the ensuing year: President, Ed Steinman, Portland; Vice-President, Ed Jannsen, Reedsville; Secretary, Art Gaunt, Aloha.

During the meeting Mr. O. F. Zinkgraf of the Washington Association and Clyde Walker, Agricultural Engineer of General Electric Company, addressed the group. Mr. R. C. Newcomb of the U. S. Geological Survey also spoke on the work of his office in connection with ground water.

WISCONSIN MEETING

Approximately 125 drillers attended the 24th annual meeting of the Wisconsin Association held in Green Bay, February 14, 15, and 16.

A program of unusual interest was presented to the meeting, including talks by E. F. Bean, State Geologist; B. H. Gustafson of the DuPont Company; R. C. Woodward of Bucyrus-Erie Company; and others.

A separate program had been prepared for the ladies.

Beck H. Goldbeck of Appleton was elected President; George Kriegel, Tigerton, First Vice-President; Martin Mastrian, Superior, Second Vice-President; and Glenn Garber, Milwaukee, Treasurer.

During the meeting Professor Bean was presented with a matched set of smoking pipes in recognition of twenty-four years of faithful co-operation with the Wisconsin Association.

NEBRASKA MEETING

The 21st annual conference and short course of the Nebraska Association was held at the University of Nebraska, February 21 and 22 in the new quarters at Bancroft Hall.

The meeting was attended by 155 members of the association and the representatives of 45 manufacturers and jobbers. The technical sessions were attended by all of those present. A very interesting part of the program was a discussion of Reverse Rotary Drilling presented by Mr. Meder Smith of Minnick and Smith, Alliance, Nebraska; O. G. Gossett of Winter-Weis Company, Denver; M. O. Kirby, Omaha Drilling Corporation; Frank Cole of Cole-Carlsen Well Company, Loomis; and Harold Elijah, Elijah Drilling Company, North Bend, Nebraska.

The annual Dutch Lunch was the high-light in entertainment. This event held at the Lincoln Hotel was enjoyed by 264 people. Special awards were made to four master drillers and eleven special drillers. Lt. Governor Charles Warner, State of Nebraska, and Regent Robert W. Devoe, University of Nebraska, were present and addressed the group, as was Dr. Condra of the Department of Conservation with one of his stirring addresses, "In Front of the Procession."

Fred D. Salmon, Concord, was elected President; Erlo Cox, North Loup, Vice-President; Andrew Olson, Oakland, Treasurer; Clyde Harmon, Scottsbluff and Frank Cole, Loomis, District Chairmen; Mr. V. H. Dreeszen, c/o University of Nebraska, is Secretary.

MISSOURI MEETING

This association held their 16th annual convention at Rolla as scheduled, March 10 and 11.

Two technical sessions and the regular business meetings were held with officers for 1952 being elected, as follows: Paul Clark, Fenton, President; Roy Wallace, Rolla, Vice-President; C. S. Wise, Kirkwood, Secretary; Frank Weldon, Cape Girardeau, Treasurer; Dale L. Fuller, Rolla, Service Secretary.

The 1953 meeting will be held at Rolla, April 13 and 14, 1953.

SOUTH DAKOTA MEETING

This association held its annual meeting at Huron, February 29 and March 1, 1952, with 87 people registered for the meeting.

Dr. E. P. Rothrock, State Geologist, spoke on the necessity for having a waterlaw in South Dakota, also Mr. C. C. Crumley of the State Board of Health on the necessity of sanitary well construction.

The annual banquet at the hotel was well attended with guests from Minnesota and other nearby states.

At the business meeting Martin Sather of Presho was elected President; Ben J. Schrag, Freeman, Vice-President; Harold P. Norbeck, Redfield, Secretary; Ray Connor, Artesian, Treasurer.

MICHIGAN MEETING

The 24th annual meeting of this association will be held in Grand Rapids, Thursday and Friday, June 26 and 27, 1952, with headquarters at the Rowe Hotel. Displays and exhibits will be at the Grand Rapids Stadium. Plans are being made to make this one of the biggest and best conventions ever held by this association, which now has

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30th Annual Meeting—Minnesota Well Drillers Association—Minneapolis, March, 1952

ASSOCIATION NEWS

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12 locals, the latest one being formed at Ludington in January, 1952.

Mr. Harold Armstrong, Battle Creek, is Chairman for the convention, and will be glad to furnish information as to details.

MINNESOTA MEETING

Mr. Norm Ovram, Executive Secretary, arranged for the 30th annual meeting of this association which was held at the Nicollet Hotel in Minneapolis, March 20, 21, and 22.

A large number of drillers from Minnesota and surrounding states were present to take part in the entertainment and program which was provided for the gathering. The entire group was entertained at lunch by the R. R. Howell Company of Minneapolis and the Edward E. Johnson, Inc. of St. Paul.

During the meeting a number of speakers appeared with some demonstrations of interest to drillers. The annual banquet and entertainment for the drillers and their wives was held at the Nicollet Hotel Friday evening, the 21st. The meeting closed with a business meeting Saturday morning at which time the present officers were re-elected for another year.

KANSAS MEETING

A representative group of Kansas drillers met in Lawrence on Saturday, March 15, as the guests of the U. S. and Kansas Geological Surveys. The meeting was held in the Mineral Resources Building at the University of Kansas, with discussion of topics pertaining to the interests of the Geological Surveys, the State Board of Health, County Agents, and Soil Scientists in the association.

A noon luncheon was served to the group at the Lakeview Club after which the meeting was resumed with Wesley Weishaar, President of the Kansas Well Drillers Association, presiding. There was a round-table discussion of NPA regulations and "The Kind of An Association I would like to have."

Mr. A. R. Leonard acted as moderator for this discussion. The arrangements were made by Dr. J. M. Jewett and Dr. V. C. Fishel of the Geological Survey.

FLORIDA MEETING

The 2nd quarterly meeting of this association was held at the Lamar Hotel, Orlando, Florida, January 5, 1952, Mr. J. P. Carroll, President, presiding. A number of items of interest to the association were discussed by those present whereupon the group adjourned to meet again on April 5 at the same place.

IOWA MEETING

The 23rd annual convention of the Iowa Well Drillers Association was held at Fort Des Moines Hotel under bad weather conditions. In spite of this, 53 drillers, 10 technical men, and 57 representatives of manufacturers and jobbers were present.

The technical sessions were well attended and those present had an opportunity to head Mr. Frank C. Foley, Geologist of the Illinois State Geological Survey tell of his experiences in supplying water to the army in Morocco and Italy. Mr. Robert L. Morriss of the Iowa State Hygenic Laboratory discussed the technicalities of bacteriological and mineralogic analysis of water. Mr. G. A. Norgaard, Economic Geologist of the Iowa Geological Survey spoke on the oil and gas possibilities of Iowa. Mr. C. R. Murray of the U. S. Geological Survey also appeared on the program regarding the need of a ground water law in Iowa.

During the meeting there was a dinner for the ladies and a "stag" for the men. The annual banquet was enjoyed by all with Dr. Hershey acting as Master of Ceremonies.

The officers for the coming year are President, C. L. Jennings, New London; Vice-President, C. C. Rasmussen, Ida Grove; Secretary-

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Treasurer, Travis C. Parker, West Branch; Directors: Sylvan R. Ames, Lincoln; C. Bonnickson, Ringstead; and Art Vinson, Fort Dodge.

THE LEGAL STATUS OF WATER

(Continued)

No specific legislation controlling diversion of water. Riparian rights for surface water. Common-law rights for ground water. Legislative acts of 1947 and 1949 give Water Improvement Advisory Commission authority to control new pollution, and existing pollution where it becomes hazardous, except for certain named "industrial streams" that are not subject to control.

ARIZONA

Doctrine of riparian rights abrogated by legislature in 1887; abrogation embodied in State constitution. Water of surface streams, "springs on the surface," and "definite underground streams" subject to appropriation by owner of irrigable land, or possessor having intent and apparent future ability to acquire ownership. Ground water assumed to be percolating unless shown definitely to constitute a "definite underground stream." American rule of reasonable use favored for "percolating waters." State laws of 1948, in effect covering ony "percolating waters," gives State Land Commissioner authority to declare "critical ground-water areas" and stop further irrigation developments therein. Law exempts domestic, stock, public, industrial, and "transportation" (railroad, etc.) wells; required registration of all existing irrigation wells, and permits for new wells. There is no statutory authority to reduce present overdevelopment, except as water of a given over-developed area might be held to constitute a "definite underground stream" and thus fall under the law of water-courses.

(To be Continued)

He—"Have our neighbors decided on a name for their new baby?"

She—"Oh yes. She was born on the wooden anniversary of her parents, so they call her "Termite."

ADVERTISEMENTS

We will insert advertisements for drilling equipment wanted or for sale, help or work wanted, etc., for our readers, free of charge. Advertisements must be brief, and we cannot assume responsibility for them, but will be glad to put parties in touch with each other by this means and suggest that they investigate any offers or inquiries carefully for themselves.

FOR SALE: A well built solid tool rig, capable of drilling 3", 4", and 5" wells; mounted on Dual Wheel rubber tire trailer; both 3" and 5" string of tools; also other 5" well tools; will sell very reasonable; leaving for service so selling out; rig also suitable for repairing wells. Write: Jim Lohse, Elbow Lake, Minnesota.

FOR SALE: One 22-W Bucyrus-Erie drill complete with derrick hoist, spooling device, casing reel, starter and generator, mounted on 1940 Chevrolet cab over truck, two speed axle; machine and truck in good condition. Price complete for machine and truck $5,000.00. Write: Hoeg & Ames, Lincoln, Iowa.

WANTED TO BUY: A pair of drill bits that will work in a 4" pipe and jars of like size; also pair of 6" bits to fit 4" and 4½" drill bar; and two large claw end drill wrenches three and one half square. Write: Adolph Rude, Flandreau, South Dakota.

FOR SALE: One Peerless, 7½ H.P. 1,800, 3P, 60C, 220V, 80' 6x1½x1" coltwo 8" LA bowls, 200 gal @ 60 ft. $600.00; two sets unused 12" bowls; 1,000 gal 90 ft. 8" col. $250.00 each; one unused 180 H.P. marine Continental engine and reduction gear. Write: American Drilling Company, Box 93, Little Silver, New Jersey.

FOR SALE: Well drilling business and equipment, including 45 x 100 warehouse and shop; doing a good business and good outlook for spring; must sell because of poor health. Write: F. E. Mead Well Drilling Company, St. Cloud, Minnesota.

FOR SALE: Money making water well drilling and pump business; three all steel well drills truck mounted, home and one and half acres of land panel and two trucks for service; get rid of casing worries, basalt formations, very little casing here; sell any part or all, might do some trade; wish to retire; Write: A. R. McInroy, Box 11, Clarkston, Washington or phone 2531-W.

WANTED: Cable tools 17¼, 15¼ and 13¼ drill bits any joint. Write: Trask Artesian Well Company, 287 Main Street, Norwich, Connecticut.

FOR SALE: Late 1949 No. 44 Cyclone oil field drill mounted on 1940 3-ton International truck with blower and lines; no tools. Write: R. R. Long, R.R. No. 6, Jacksonville, Illinois, telephone 512.

FOR SALE: Failing and Sullivan rotary drills, complete, truck mounted, tools, drill rod, etc. priced $5,000.00 to $8,500.00. Write: Fred E. Butler, Box 1832, Casper, Wyoming.

FOR SALE: 21-W, Style D Mounting, less truck, including cable and sand line, catheads on machine; condition of machine good; purchased new in March, 1948. Write: Leo Lutz, Osceola, Wisconsin, phone LD 212.

FOR SALE: A Keystone No. 4 well drilling machine, mounted on a 2-ton International truck; good tires and truck in good condition; equipped with tools and lines; has a steel "A" Nash derrick 36 ft. high; this machine is in good running condition; also good power plant; price reasonable. Write: W. K. Massey, 693 Lawton Street, S. W., Atlanta, Georgia, Phone Franklin 2368.

FOR SALE: One Marvel well machine mounted on truck, equipped with tools; also another set of drilling tools; cheap; reason for selling is death of owner. Write: Mrs. Herman Miller, R. D. No. 1, Montoursville, Pennsylvania.

WANTED TO BUY: One 6" drill for 3" diameter bar 1½ by 2¼ 8a P.I. thread; also one good used welder 200 or 250 amp capacity 4 cylinder V type motor preferred; also one substitute 1½ by 2¼" API pin 8 - 1⅝" by 2⅝" 7a P.I. box; also one swedge for screen for 4" diameter wells and one swedge for screen for 6" diameter wells. Write: Carl Bolliger, 411 E. Oak, Fairbury, Ill.

FOR SALE: No. 160 Howell Machine mounted on 3-ton International truck with winter inclosure. 1,500' of ¾" drill line, some of sand line. 2 Drill Stems, one 3", one 5"; 2 - 5½" Drill Bits; 1 - 5" Drill Bit; 1 - 6" Drill Bit; 1 - 8" Drill Bit; 1 - 4" Drill Bit; 2 - 4" Bailers; 1 - 5⅝ Swedge; Bit Wrench, Hand Tools, Jackscrews, etc., Grease Outfit. Jetting Attachment complete mounted on two-wheel trailer, twin cylinder jetting pump 4½" powered by 4 cylinder LeRoi engine 3⅝ x 3½" bore, gasoline or natural gas manifold. 150 1" extra heavy drill rod. 1937 Ford water tank truck power take-off pump. Portable electric welder on two-wheel trailer Hobert type M.B. 200 amp. 4 cylinder gasoline motor, used very little. Rig in A-1 condition. Hasn't been used since it was overhauled. Price, $5,000.00. Write: Carl Settle, Box 677, Wibaux, Montana.

FOR SALE OR TRADE: Mobile drill earth augering machine with 100 feet of 4½" augers, capable of drilling 125 ft. Walls up its own hole in otherwise loose formations, like gravel. Also wanted to buy: Bucyrus-Erie 20W or 22W or similar machine with tools, prefer 3", 4", and 5" tools. Must be a bargain and in good condition. Write Elmer Crain, 311 W. Division Street, Boyne City, Michigan.

FOR SALE BY OWNER: One 6 stage Smithway water lubricated deep well turbine, complete with right angle gear drive for 500 g.p.m. 225' total head, 1,760 r.p.m. 70 feet 6" x 1¼" column, 20' suction pipe, prelubricating tank and fittings; pump brand new never uncrated; price $1,850.00, immediate delivery. Write or wire, Box ABC, 2304 Long Avenue, St. Paul 4, Minnesota.

FOR SALE: Fort Worth spudder, model C, built to handle up to 3,500 pounds of tools down to about 500 feet or will drill small holes to 1,500 feet; tools from 6" to 18"; International K-7 truck; rig was rebuilt two years ago and in good condition. Write: W. D. Jones, Route 3, Hereford, Texas, telephone 9008-F3.

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FOR SALE: Bucyrus-Erie 28-L, semi-trailer mounting; purchaesd new August 1948; excellent condition; price $13,750.00, with complete line of tools and extra equipment $17,500.00. Write: R. S. Knapp, 8845 Main Street, Clarence, New York.

FOR SALE: Drilling business in Farmington, Michigan; one Cyclone '42; four years old, drilling machine truck mounted with 600 ft. new cables; one 1946 Studebaker 1½ ton truck with built-in tool boxes; modern drilling and retrieving tools for 3", 4", 5", and 6" wells; also surging blocks, threading dies, and pipe cutters from ⅛" to 6" acetylene torch, several hundred dollars in small tools too numerous to mention; $6,500.00; plenty of work, room for expansion to four drilling machines or more; other interests, reason for selling. Write: Joseph N. Cauffiel, 29093 List Street, Farmington, Michigan, telephone Farmington 2405.

FOR SALE: One #240 Speed Star rig in first-class condition; self starter, power unit, slow speed catheads; 33' mast and a complete string of 4" tools, rig mounted on K-5 International truck, truck in first-class condition; good tires, and will go anywhere; rig now drilling. Write: George I. Warner, McBean, Georgia, telephone 4-2632.

FOR SALE: Two used machines, telescope derricks, truck mounted; can be seen running; excellent condition; priced to sell. Write: Creelman Artesian Well Company, 38 Maple Street, Dover, New Hampshire.

FOR SALE: To settle an estate. Bucyrus-Erie new tools, never used, threads greased and bright all API; one swivel wire rope socket 3¼"x4¼"-7 with box protector and mandrel; One drill stem 6"x10' LG 3¼"x4¼"-7 pin joint, 4"x5"-7 box and protectors; two jack end tools wrenches, right hand and left hand; one No. 2 oil well circle jack; one fishing jar 6"x24" stroke 3¼"x4¼"-7; two drill bits regular 1,000 lb. 4"x5"-7 with protectors; one fishing jar 5½"x36", 2¾"x3⅜"-7; one drill stem 5"x20' wgt. 1,337, 2¾"x3⅜"-7 drive clamps heavy pattern, size square 3½" diam; 4"x4½"x 16" weight 204 lbs.; one No. 22 Barrett swivel wrench with plate and two squares; will sell all for 25% of new price; one box with bail for handling bits 4"x5"-7. Write or call: Maurice Wells, Oakfield, Wisconsin, Route 2, telephone 81F2; four miles south of Oakfield.

FOR SALE: No. 30 Sparta Wood frame band wheel type machine, steel 38' one-piece derrick; mounted on 2½ ton 1934 Dodge truck, complete with 350'-⅝" drilling cable and 350'-⅜" sand line; bargain with or without tools. Write: Ray Van Hercke, Little Falls, Minnesota.

FOR SALE: Two No. 26 Cyclone drilling machines; two No. 2 Clipper Machines; one Ideco No. 6 in new condition; one Kalamazoo Hollow Rod Machine; tools for above are available, all are truck mounted and in good condition; all or your choice at a bargain price. Write: Norman Staebler, Turner, (Arenac County), Michigan.

New Jersey contractor using drive points to dewater wet sewer job.

FOR SALE: 1947 No. 71 Speed Star mounted on 1940 Chevrolet 1½ ton Thornton rear end tamden drive truck; this machine newly cleaned and painted and in storage two years; 40' mast 47 h.p. Continental red seal motor, dual catheads, blower mounted on rig, tool guide; complete string 6" tools; price $4,200.00. Also Bucyrus-Erie 33W on 1937 Chevrolet 1½ ton truck, no tools, price $2,000.00. Write: W. J. Rodgers, Gulliver, Michigan, phone 3392 after seven in the evenings.

FOR SALE: Two truck mounted drilling machines with 600 feet of ⅝" drill line and ⅜" sand line, machines and trucks are in good condition, with good rubber; one goose-neck trailer mounted 71 Star; this machine is in good shape with new V-belts and brake lining on bull and sand reel; tools from 5 to 12 inches; plenty of drill bits; nine stems jars, swivel sockets, set of elevators, swivel wrench, circle jack drive blocks, some fishing tools and pump tools, also have about 500 feet of new 5-inch pipe that will go with this equipment if sold as a unit; will sacrifice for $5,500.00 cash. Write: John R. Neidig, Route 1, East Moline, Illinois.

WANTED: Acme 3 cutter underreamer for 4" hole, w/ 1½x2¼x8 API pin, must be in good condition; Straight blade star bit for 4" hole, 1½x2¼x8 API pin jt., weight 150 lbs.; one set tool wrenches, claw end for 2½ or 2¾ sq. w/bar and chain tightner for same. Write: Kriska Well Drillers, Seffner, Florida.

FOR SALE: One set of 6" drilling tools with two drills, 12' stem, blocks and wrenches and socket; used only on one well; $450.00. Write: Chester R. Drake, Marshall Well Service, 329 S. Grand Street, Marshall, Michigan.

WANTED: Clutch for a Cyclone No. 10 wooden frame drill machine about 40 yrs. old. Write: R. F. Hair, Route 2, Box 429-B, South Military Trail, West Palm Beach, Florida.

FOR SALE: Model 50 Keystone drilling machine with Buda engine, 38-ft. mast, tool guide and cable holder; in A-1 condition, stem, jars and swivel rope socket, practically new; bits for 4⅞", 5¼", 6¼", 8", and 10" holes; machine just mounted on a good White truck last summer, new battery; good tires; two good spares; reason for selling, been in the busines for 50 years and wish to retire. For more information, write or call: E. C. Rudert, Box 32, Saxonburg, Pennsylvania.

FOR SALE: Five inch 30-ft. long drill stem; two 12-inch drilling bits. Write: Hagenah Well Drilling, Cole Camp, Missouri.

FOR SALE: Good home-made hydraulic well drill, wood frame, 5 h.p. engine mounted on trailer, rubber tires, with or without tools; 200-ft. drill rods and bits from 2" to 5". Write: L. V. Croot, Iowa Falls, Iowa.

FOR SALE: All steel rebuilt Lydecker mounted on '34 Ford truck; two strings of tools; 1"x3"x18' stem, 2½" pin; 1"x3½"x14' stem, 3" pin; jars for both stems, wrenches; toggle bar, circle and jacks, 4, 5, 6, and 8" bits; drive clamps and chain tongs; pipe wrenches, chains, chain hoist, pipe fittings, blower and forge, hand tools, and everything needed to drill a well; everything for $900.00. Write: A. N. Leatherwood, 3036 Clime Road, Columbus 4, Ohio.

FOR SALE: No. 40 Speed Star, 31-foot derrick power hoist; Continental 4-cylinder motor with starter; 400 feet ⅝" drilling cable; 300 feet ⅜" sand line with a string of 4" tools, joints thread 1½x2¼x8 API. All this rig needs is a driller as I am unable to operate it. Priced $1,200.00, less truck; also have for sale one string new 6" tools and miscellaneous items at $400.00. Write: Richard Henderson, Route 2, Kewanna, Indiana.

(Continued on Page 15)

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FOR SALE: Well drilling business, 71-Star, modernized No. 3 Keystone, both truck mounted; complete tools 4" to 20". Physical inventory $15,000.00. Nets $6,000.00 to $8,000.00 yearly; this is industrial — no pipe worries. SALES PRICE: $11,000.00. Owner retiring. Write Box NDM, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 4, Minn.

FOR SALE: Failing and Sullivan rotary drills, complete, tools, drill pipe, etc. Priced from $4,500.00 to $8,500.00. Write: Fred E. Butler, Box 1832, Casper, Wyoming.

FOR SALE: Two-55 Speed Stars, 1951 models, used 5 months. Both unmounted with telescoping masts, casing reels, double cat heads, electric starters. Rigs purchased new for contract job at $4,400.00 each. Will sell for $3,000.00 each. Extra parts we have will go with the rigs. Omaha Drilling Co., 624 Service Life Bldg., Omaha 2, Nebraska.

FOR SALE: Bucyrus-Erie 22-W, excellent condition, has casing reel, besides drilling and sand lines. Power mast-raising reel. Mounted on 2½ ton G.M.C. tandem truck. With lines and tools $5,000.00. Omaha Drilling Co., 624 Service Life Bldg., Omaha 2, Nebraska.

FOR SALE: 71 Speed Star, nearly new, 40-foot telescoping mast, drilling, sand and casing reels, double cat heads, power mast-raising reel. Rig fitted with Star rotary attachment consisting of guides, swivel, 4½"x21' round splined kelly, and rotary table complete. This rig can do cable tool drilling to 1,000 feet and can be converted into rotary rig in a few minutes. Rig is mounted on 1942 K-7 International truck. Complete with everything as is $8,500.00. Omaha Drilling Co., 624 Service Life Bldg., Omaha 2, Nebraska.

FOR SALE: One all steel No. 42 Cyclone drill three years old, truck mounted on '45 Studebaker 6 wheel, truck A-1 and looks the same; machine has drilled about 2,000 feet of shallow hole, looks new and runs the same; engine Red Seal Continental uses no oil; factory rating of rig is 650 feet with 1,500 lbs. of tools; spools over 1,000 feet of cable and is equipped with 750 feet of new ⅝" and ⅜" sand line; derrick is 36-ft. telescoping with power hoist, and tool guide; tools 3"x16' drill bar, 1-4" and 5" bits; swivel socket, drive clamps and wrenches, no-kink, 2 chain wrenches, pressure grease gun; spare tire, derrick, jacks, quick change link on sand line; ready to go for $3,950.00, f.o.b. Antioch, Illinois. Write: C. L. Wertz, Antioch, Illinois, or telephone 403-J.

FOR SALE: Dempster B-15 for sale, trailer mounted, 20 h.p. motor. Bargain $675.00; machine in operation now. Write: W. A. Snyder, Bayard, Nebraska.

FOR SALE: Entire stock of well drillers pipe, over 3,000 feet of 6", 5", 4" and 2"; all couplings and drive shoes. Write: Clarence Chadwick, Deford, Michigan.

FOR SALE: Portable, truck mounted rotary drills, Failing and Sullivan, 1000', 1500' and 2000' capacity, complete tools, pipe, etc. Write: Fred E. Butler, Box 1832, Casper, Wyoming.

FOR SALE: One Bucyrus-Erie 22-W trailer mounted drilling machine; tool guide; catheads; casing reel, Hercules six-cylinder motor; $3,900.00; tools extra; have tools from 4" to 20"—4", 6", 8", 12", 14", 20" bits, 2 stems; wire lines. Write: Jim Feighey, Julesburg, Colorado.

WANTED: Jet well drill machine, give full details and price. Write: Gerald W. Carlson, 722 First Avenue North, Jamestown, North Dakota.

Statistics

If all of the automobiles in the world were put end to end, 98% of the drivers would immediately pull out of line to pass the car ahead.

MYERS ANNOUNCES ADDITIONS TO "HN" LINE

A water system for every purpose is now a reality, according to the F. E. Myers & Bro. Co., of Ashland, Ohio, which has just announced full production on two major additions to its "HN" line of **Ejecto** Water Systems and Pumps.

The additions are a one and a half and two horsepower motor sizes with full variations for specific uses. The variations include a shallow well EJECTO pump, a deep well twin-type and a deep well packer type. The Myers company said that the two new horsepower sizes are a continuation of its present line of "HN" EJECTOS which include ½, 1 3, ¾, and one horsepower sizes. The new sizes offer all of the features of the smaller systems but are designed for greater head and capacity.

The new sizes are of particular benefit to consumers whose requirements are for higher capacities than those furnished by the smaller systems—poultry raisers, large dairy farms, rural schools and apartment districts who draw their own water supply and the like.

The Myers "HN" series of water systems has long been regarded by consumers as outstanding. Some of the features that have sold users on the "HN" series are the simple procedure needed to convert the system from shallow well to deep well use, the high efficiency, the simple mechanical construction making servicing and installation easier, a standardized motor loading and an improved appearance over standard makes. An example of the simplicity of these pumps is shown by the ease of converting from shallow to deep well use. It is necessary to change only one threaded connection and add necessary well pipe and deep well Ejector. No bolts, gaskets, special parts or tools are required.

All motors used in the "HN" line are of nationally known makes and are made in accordance with N e m a standards specifications. This assures the reliability of performance and guarantees availability of parts and service for the life of the motor.

The ejector assembly used in the one and a half and two horsepower pumps are all bronze and are available for single or two pipe installation, shallow and deep well. The single pipe or packer type is made for use in three and four inch wells. The two pipe or twin type ejector is made for use in 5⅝ inch or larger wells.

To permit a minimum of stock to meet all well conditions, the new pump units and ejector assemblies, as in the past, are packaged separately. With this system, one basic pump unit and several ejector packages make it possible to meet any well condition within the range of the pump. This means immediate delivery for any consumer needs.

New Myers Pump.

HOW MUCH IS *Your* EXPERIENCE WORTH

If you could sell your experience for what it cost you, you could quit working right now and retire.

Experience costs a lot and is worth a lot, in the manufacture of well screens and in everything else in life. Edward E. Johnson, Inc., can offer you a superior well screen because nearly half a century of experience and development goes into the present screen. This 50 years has been devoted entirely to the problems of making the water supply of the country safer and more assured.

There is no other company in the United States — or in the world — that has specialized in the manufacture of well screens exclusively for that period of time.

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OUR GREATEST ASSET
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